

**CLAIMS**

1. A high silicon stainless steel which mainly comprises a microstructure with a grain size of 15  $\mu\text{m}$  or less and which has an elongation at break of 12% or  
5 higher.

2. A high silicon stainless steel which mainly comprises a microstructure with a grain size of 7  $\mu\text{m}$  or less and which has an elongation at break of 14% or  
10 higher.

3. A high silicon stainless steel according to claim 1 or 2,

wherein the high silicon stainless steel is  
15 subjected to thermal aging at a temperature range of 480 to 550°C, and achieves an elongation at break of 7% or higher after the thermal aging.

4. A high silicon stainless steel according to claim 3, wherein the high silicon stainless steel has a Brinell  
20 hardness of 450 or higher.

5. A spring which is made of the high silicon stainless steel according to any of claims 1 to 4.

6. A process for manufacturing a high silicon stainless steel which comprises the step of forging a high silicon stainless steel or a master alloy thereof, the forging step including:

5 a load application step for applying an impact load and/or a static load to the high silicon stainless steel or the master alloy, wherein a surface temperature of the high silicon stainless steel or the master alloy is kept at 1,100°C or higher, and is later dropped to  
10 a temperature range of 950°C or below and not so low as to break the high silicon stainless steel or the master alloy,

such that the process provides a steel material which mainly comprises a microstructure with a grain  
15 size of 15  $\mu\text{m}$  or less.

7. A process for manufacturing a high silicon stainless steel which comprises the step of forging a high silicon stainless steel or a master alloy thereof, the forging step including:

a first load application step for applying an impact load and/or a static load to the high silicon stainless steel or the master alloy, wherein a surface temperature of the high silicon stainless steel or the  
25 master alloy is kept at 1,100°C or higher, and is later

dropped to a temperature range of 950°C or below and not so low as to break the high silicon stainless steel or the master alloy; and

a second load application step for applying an  
5 impact load and/or a static load to the high silicon stainless steel or the master alloy, wherein a surface temperature of the high silicon stainless steel or the master alloy is kept at a temperature range from 850 to 1,050°C, and is later changed to a temperature range  
10 of 950°C or below and not so low as to break the high silicon stainless steel or the master alloy,

wherein the first load application step is followed by the second load application step once or more,

15 such that the process provides a steel material which mainly comprises a microstructure with a grain size of 15  $\mu\text{m}$  or less.

8. A process for manufacturing a high silicon  
20 stainless steel according to claim 7,

wherein a lowest surface temperature for the second load application step is lower than a lowest surface temperature for the first load application step,

wherein the second load application step is  
25 conducted more than once, during which a lowest surface

temperature for each second load application step is lower than a lowest surface temperature for a previous second load application step so as to reduce a grain size little by little, and

5            wherein the grain size is controlled by changing the number of times for conducting the second load application step,

             such that the production process provides a steel material which mainly comprises a microstructure with  
10    a grain size of 15  $\mu\text{m}$  or less.